

UNDERSTANDING PHYSIOLOGY

CVS



Regulation of the Diameter of Arteriole



UNDERSTANDING PHYSIOLOGY

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Cardiovascular Innervations

I-Cardiovascular Receptors

Baroreceptors

A- Arterial Baroreceptors — ABP

B- Atrial Baroreceptors — Atrial pressure

Chemoreceptors

A- Arterial (= Peripheral) Chemoreceptors. — $-O_2$, $++CO_2$, & $++H^+$.

B- Coronary Chemoreceptors — certain chemicals

II- Cardiovascular Centers

CIC

VMC

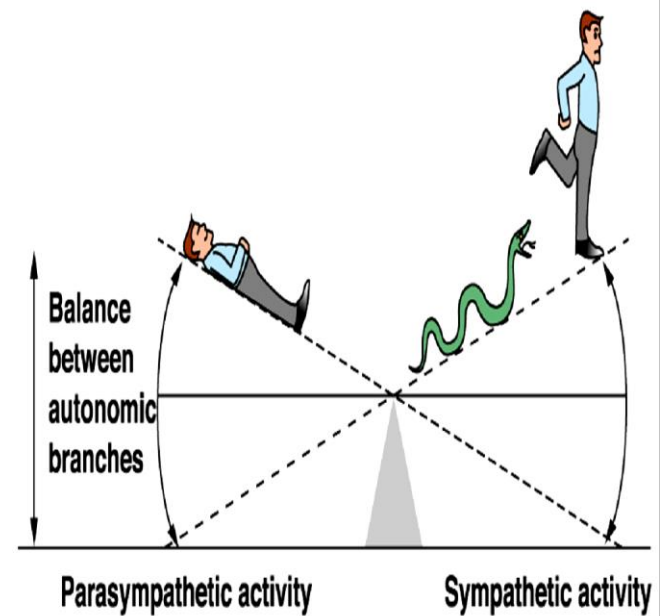
VCC

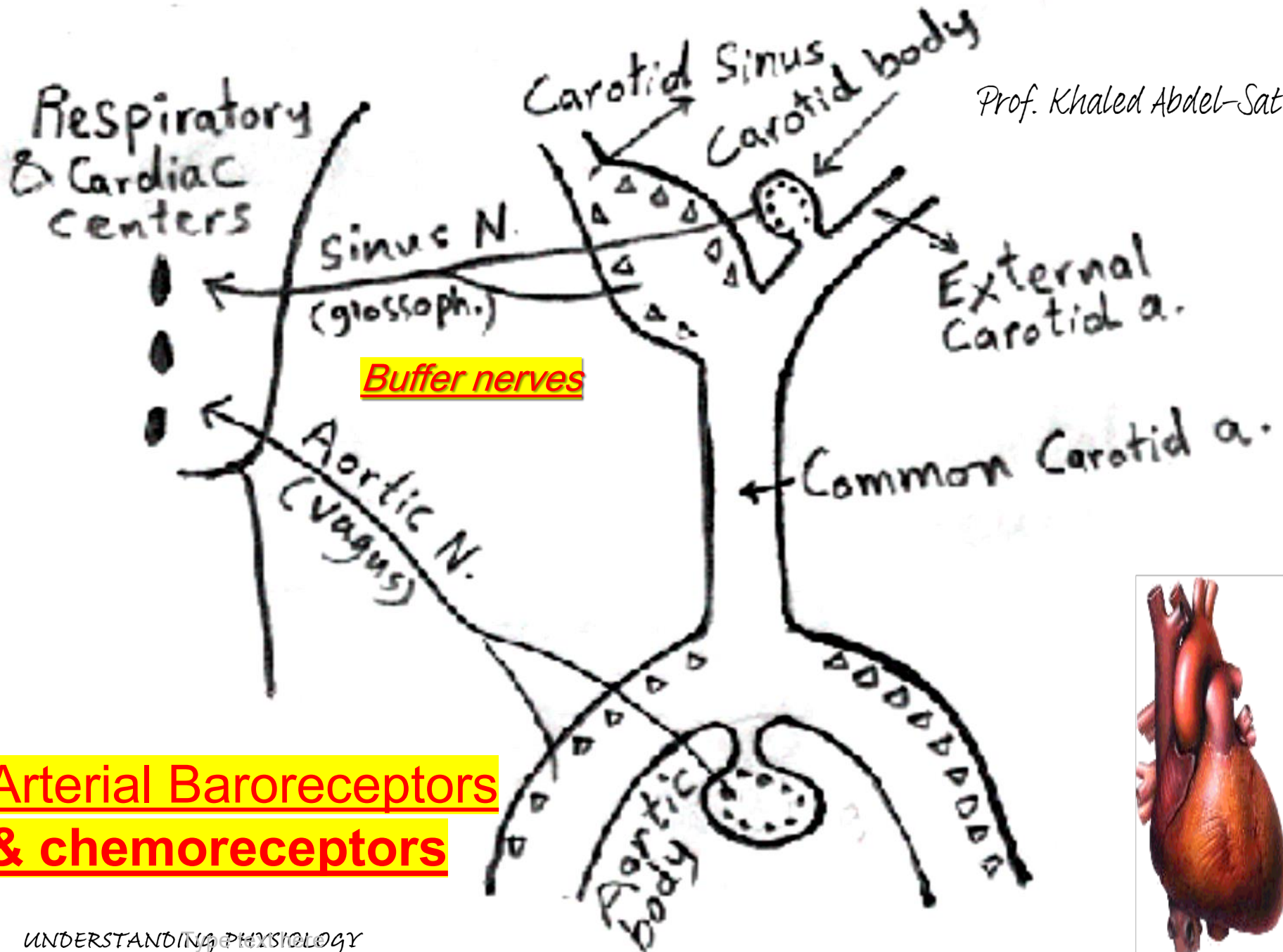
VDC

III-Cardiovascular Autonomic Nerves

Sympathetic

Parasympathetic (vagi)





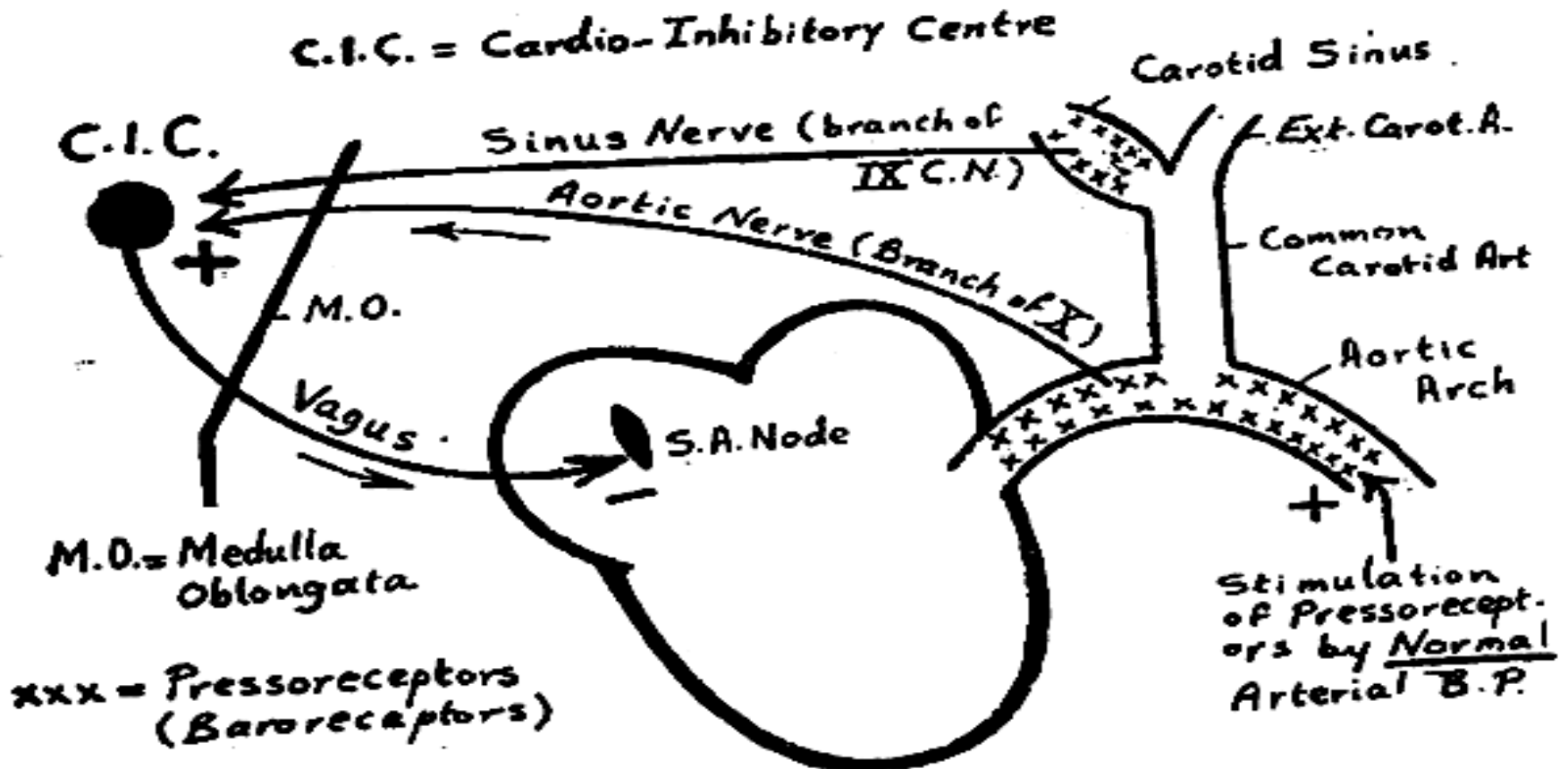
Arterial Baroreceptors & chemoreceptors

Vagal Tone

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continuous inhibitory effect by the vagi on the heart during rest \Rightarrow \downarrow the high SAN rhythm from about 100 \Rightarrow 75 impulses/min.

Mechanism:

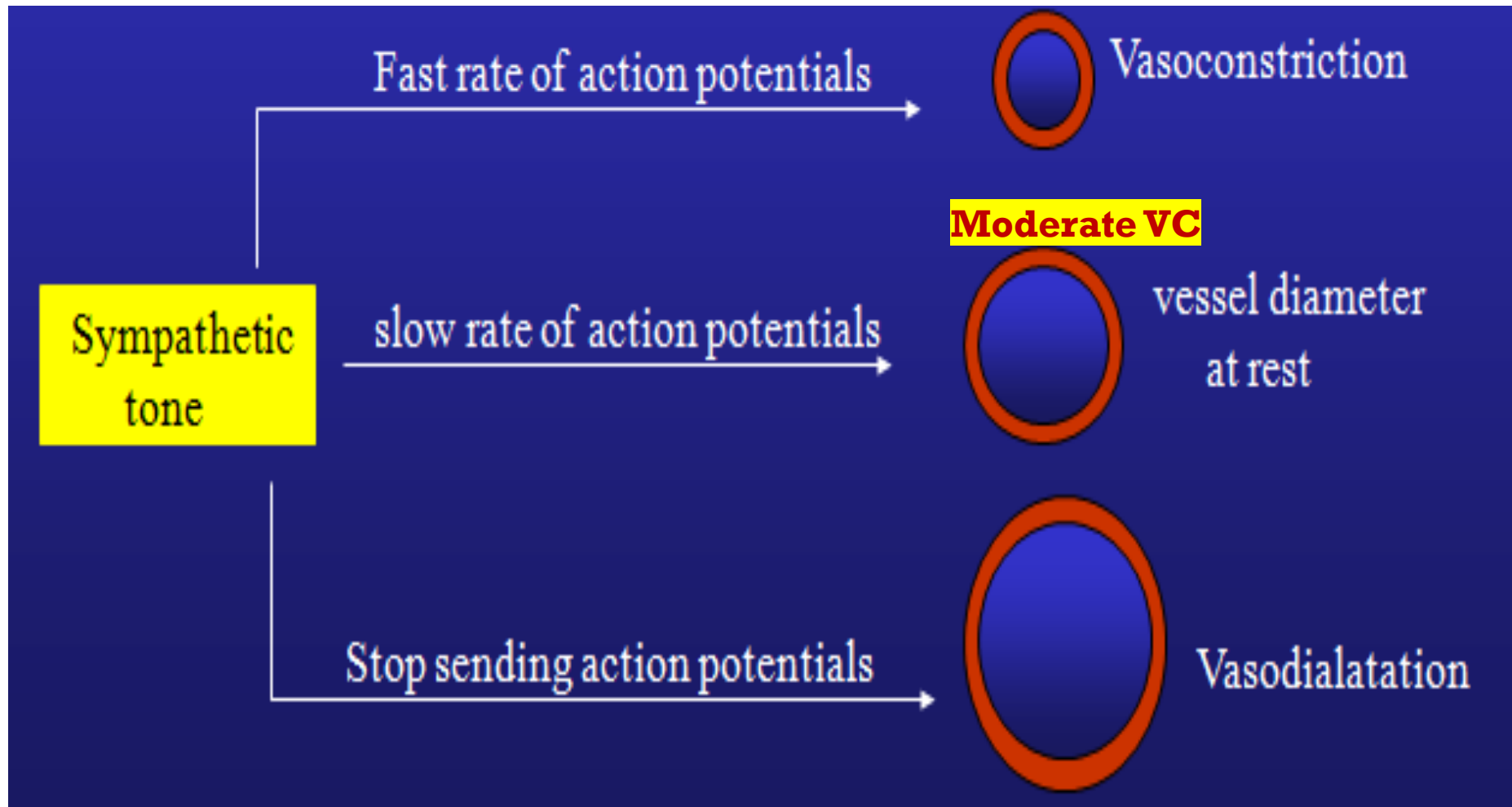


Sympathetic Tone

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(**vasoconstrictor tone**)

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During rest, sympathetic is dominant in blood vessels this is called sympathetic tone → VC



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I - Nervous Regulation:

A – Impulse from Circulatory System:

1 – From Arterial Baroreceptors: depressor

- **Stimulus:** e.g. \uparrow ABP.
- **Receptors:** Baroreceptors in aortic arch & carotid sinus.
- **Afferent:** Aortic and carotid sinus nerves.
- **Center:** Inhibition of VCC in medulla oblongata.
- **Efferent:** Inhibition of sympathetic nerves.
- **Response:** VD \Rightarrow \downarrow ABP.
- **Importance:** This reflex prevents marked increase or decreased of ABP.

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I - Nervous Regulation:

A – Impulse from Circulatory System:

2- From Arterial Chemoreceptors: pressor

-**Stimulus:** lowered O_2 tensions, elevation CO_2 pressure, or/and H^+ concentration.

-**Receptor:** Chemoreceptor in aortic and carotid body.

- **Afferent:** Aortic and carotid sinus nerves.

- **Center:** Stimulation of VCC in medulla oblongata.

- **Efferent:** Stimulation of sympathetic nerves.

-**Response:** Generalized vasoconstriction \Rightarrow \uparrow

ABP.

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I - Nervous Regulation:

A – Impulse from Circulatory System:

3- From Atrial Baroreceptors (Stretch Receptor) (McDowell's Reflex): **pressor**

- Stimulus**: Both decrease or increase of intra-arterial pressure.
- Receptor** : Stretch receptors in the atrial wall.
- Afferent** : Vagus nerve.
- Center** : Stimulation of VCC in medulla oblongata.
- Efferent** : Stimulation of sympathetic nerves.
- Response** : Generalized vasoconstriction \Rightarrow \uparrow ABP.

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I - Nervous Regulation:

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A – Impulse from Circulatory System:

4- From Ventricular & Coronary

Chemoreceptors: (Bezold Jarisch reflex).

-Stimulus: stimulation of the diseased myocardium by certain chemicals as serotonin, capsaicin or nicotine (as in myocardial infarction).

-Receptors: In left ventricle near the coronary vessels.

-Afferent: C-afferent fiber.

worsens the shock

- Center : Inhibition of VCC in medulla oblongata.

-Efferent : Inhibition of sympathetic nerves.

-Response : Generalized vasoconstriction \Rightarrow VD & \downarrow ABP.



B – Impulse from Higher Center:

1 – Respiratory Center: ABP raises 4-6 mmHg during inspiration and falls during expiration (stimulation of inspiratory center \rightarrow \uparrow VCC)

2 –The Cerebral Cortex:

-Condition Reflexes: e.g. flushing of face when one is embarrassed.

-Emotion: a- Moderate emotion stimulates VCC \Rightarrow \uparrow ABP. b-Sever emotion inhibits VCC \Rightarrow \downarrow ABP.

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-Exercise stimulates VCC \Rightarrow \uparrow ABP.

B – Impulse from Higher Center:

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3 – Hypothalamus: pos= sym+cold

□ Center for autonomic nervous system

- Stimulation of anterior hypothalamus causes vagus stimulation → VD & ↓ ABP.
- Stimulation of lateral hypothalamus (= sympathetic stimulation) → VC & ↑ ABP.

□ Center of emotion. (Sever ↓ ABP)

□ Center of temperature regulation:

- i- Exposure to cold ⇒ vasoconstriction & ↑ ABP.
- ii- Exposure to hot ⇒ vasodilatation & ↓ ABP.

•C. Impulses form other Part of the Body:

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• 1-Pain Receptor: i- Moderate pain \Rightarrow reflex VC & \uparrow ABP. ii- Sever pain \Rightarrow reflex VD & \downarrow ABP.

• 2-Skeletal Muscle: Contraction of skeletal muscle \rightarrow VC & \uparrow ABP. To supply the active muscle with O₂ & nutrients.

• 3- Cold Pressor Reflex Test:

- (4 °C) \Rightarrow ABP \uparrow by about 20 mm Hg. In hypersensitive & susceptible persons to develop hypertension, it \uparrow more than 20 mm Hg.

•C. Impulses form other Part of the Body:

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4- Loven's Reflex:

-Stimulus: Increase the activity of an organ \Rightarrow release of metabolites that stimulate **-Receptor:** organ sensory receptors. **-Afferent:** organ afferent nerve. **-Center:** stimulation of VCC. **-Efferent:** stimulation of sympathetic nerves. **-Response:** Generalized vasoconstriction all over the body.

-Importance: shifting of blood from rested organ to active organ \Rightarrow supplying this organ with more O_2 & removal of accumulated metabolites.

II. Humoral Regulation:



A-Vasodilators:

1- Metabolites:

	Active hyperemia	Reactive hyperemia
● <u>Definition:</u>	- It is an ↑ in blood flow through an organ when its activity ↑.	- It is an ↑ in blood flow through an organ after removal temporary occlusion of its arterial blood supply.
● <u>Mechanism:</u>	- ↑ organ activity or temporary occlusion ⇒ ⇒ local hypoxia & release of large amounts of vasodilator metabolites.	

2- Acetyl choline: 3- Histamine

4- Atrial natriuretic peptide:

5- Endothelium-derived relaxing factor =Nitric oxide.

6-Vasoactive inhibitory peptide

•B-Vasoconstrictors:

1- Catecholamines (adrenaline, noradrenaline and dopamine)

2-ADH

3- Serotonin

4- Angiotensin II and thromboxane A2.

GOOD LUCK



Thanks